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MS PETITION  
PATENT  
2632-0142P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Chung Nam WHANG et al. Conf.: 7521

Appl. No.: 09/828,819 Group: 1773

Filed: April 10, 2001 Examiner: N.J. UHLIR

For: A MAGNETIC FILM HAVING EASY-AXIS OR A  
MULTIPLE EASY-AXIS AND A METHOD OF  
MANUFACTURING THE MAGNETIC FILM

PETITION FOR REVIVAL OF AN APPLICATION FOR PATENT  
ABANDONED UNINTENTIONALLY UNDER 37 C.F.R. § 1.137(b)

**MS PETITION**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

May 10, 2004

Sir:

The above-identified application became abandoned for failure to file a timely and proper reply to a notice or action by the United States Patent and Trademark Office. The date of abandonment is the day after the expiration date of the period set for reply in the Office notice or action plus an extension of time actually obtained.

APPLICANT HEREBY PETITIONS FOR REVIVAL OF THIS APPLICATION

Note: A grantable petition requires the following items:

- (1) Petition fee;
- (2) Reply and/or issue fee;
- (3) Terminal disclaimer with disclaimer fee -- required for all utility and plant applications filed before June 8, 1995; and for all design applications; and
- (4) Statement that the entire delay was unintentional.

1. Petition fee

- Small entity - fee \$665.00 (37 C.F.R. § 1.17(m)).  
Applicant claims small entity status. See 37 C.F.R.  
§ 1.27.
- Other than small entity - fee \$1,330.00 (37 C.F.R.  
§ 1.17(m))

2. Reply and/or fee

- A. The reply and/or fee to the above-noted Office action  
in the form of an Amendment (identify type of reply):
- has been filed previously on February 27, 2004  
and a copy thereof is attached hereto.
- is enclosed herewith.
- B. The issue fee of \$0.00
- has been paid previously on .
- is enclosed herewith.

3. Terminal disclaimer with disclaimer fee

- Since this utility/plant application was filed on or  
after June 8, 1995, no terminal disclaimer is  
required.
- A terminal disclaimer (and disclaimer fee (37 C.F.R.  
§ 1.20(d)) of \$55.00 for a small entity or \$110.00 for  
other than a small entity) disclaiming the required  
period of time is enclosed herewith.

4. Statement: The entire delay in filing the required reply  
from the due date for the required reply until the filing  
of a grantable petition under 37 C.F.R. § 1.137(b) was  
unintentional.

- No fee is required.
- Check(s) in the amount of \$665.00 is/are enclosed.
- Please charge Deposit Account No. 02-2448 in the amount of \$0.00. This form is submitted in triplicate.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By Joseph A. Kolasch # 28380  
for Joseph A. Kolasch, #22,463

P.O. Box 747  
Falls Church, VA 22040-0747  
(703) 205-8000

JAK/RFG/gf  
2632-0142P

- Attachments:
- Fee Payment
  - Reply
  - Terminal Disclaimer Form
  - Additional sheets containing statements establishing unintentional delay
  - Other:

(Rev. 02/18/2004)



PATENT  
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IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Chung Nam WHANG et al. Conf.: 7521  
Appl. No.: 09/828,819 Group: 1773  
Filed: April 10, 2001 Examiner: N. J. UHLIR  
For: A MAGNETIC FILM HAVING EASY-AXIS OR A  
MULTIPLE EASY-AXIS AND A METHOD OF  
MANUFACTURING THE MAGNETIC FILM

COPY

SMALL ENTITY TRANSMITTAL FORM

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

February 27, 2004

Sir:

Transmitted herewith is an amendment in the above-identified application.

- Applicant claims small entity status under 37 C.F.R. § 1.27.  
 The enclosed document is being transmitted via the Certificate of Mailing provisions of 37 C.F.R. § 1.8.  
 The enclosed document is being transmitted via facsimile.

The fee has been calculated as shown below:

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR			PRESENT EXTRA	RATE	ADDITIONAL FEE
TOTAL	4	-	20	=	0		\$ 9	\$ 0.00
INDEPENDENT	1	-	8	=	0		\$ 43	\$ 0.00
<input type="checkbox"/> FIRST PRESENTATION OF A MULTIPLE DEPENDENT CLAIM							\$145	\$ 0.00
							TOTAL	\$ 0.00

Appl. No. 09/828,819

- Petition for one ( 1 ) month(s) extension of time pursuant to 37 C.F.R. §§ 1.17 and 1.136(a). \$0.00 for the extension of time.
- No fee is required.
- Check(s) in the amount of \$110.00s(are) enclosed.
- Please charge Deposit Account No. 02-2448 in the amount of \$0.00. This form is submitted in triplicate.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By   
Joseph A. Kolasch, #22,463

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2632-0142P

Attachment(s)

(Rev. 09/30/03)



PATENT  
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IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Chung Nam WHANG et al. Conf.:7521  
Appl. No.: 09/828,819 Group: 1773  
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For: A MAGNETIC FILM HAVING EASY-AXIS OR A  
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MANUFACTURING THE MAGNETIC FILM

***REPLY UNDER 37 C.F.R. § 1.111***

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

February 27, 2004

Sir:

In reply to the Office Action dated June 6, 2003, and subsequent to the filing of a Notice of Appeal on December 8, 2003, the period for response being extended one (1) month to expire on March 8, 2004, the following amendments and remarks are respectfully submitted in connection with the above-identified application.

Amendments to the Specification being on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 7 of this paper.

Amendments to the Drawings being on page 8 of this paper and include both an attached replacement sheet and an annotated sheet showing changes.

Remarks/Arguments begin on page 9 of this paper.

Amended drawing figures are attached following page 13 of this paper.

## **AMENDMENTS TO THE SPECIFICATION**

Please replace the paragraph beginning on page 2, line 21 with the following amended paragraph:

In general, the RAM (Random Access Memory) representing the primary memory is made of semiconductor. Therefore, price per unit capacity of the memory is very expensive compared to the hard disk representing the secondary memory. Besides, as almost all kinds of primary memory are volatile, information is erased when the electric power is turned off. There are non-volatile RAM such as SRAM (Static RAM) and FRAM (Flash RAM), however, they are more expensive than volatile DRAM (Dynamic RAM). Some developers introduced MRAM (Magnetic RAM) to the market in order to get a new type of non-volatile RAM with low cost. Fig. 2 shows the general structure of the MRAM. The basic principle of the MRAM comes from the MR (Magnetic Resistance) head. A plurality of word line 61 running in one direction is arrayed with a gap. On the each word line 61, a plurality of magnetic bit cell 55 is arrayed. A plurality of bit line 63 running in the other direction crossing the word line 61 is arrayed on the magnetic bit cell 55. That is, the word line 61 and the bit line 63 cross each other in the three dimensional space, and the bit cell 55 is sandwiched at the crossing area of the word line 61 and the bit line 63. Here, the bit cell 55 comprises a first ferromagnetic layer 71 contacting the word line 61, a second ferromagnetic layer

73 contacting the bit line 63 and a tunneling barrier layer [[77]] 75 inserted between the first 71 and second ferromagnetic layer 73. The first ferromagnetic layer 71 is magnetized in parallel direction to running direction of the word line 61. If the magnetized states of the first 71 and the second ferromagnetic layer 73 are the same, the bit cell represents "0" of digitized value because the current resistance among the bit cells 55 is low. Otherwise, the bit cell represents "1" as the current resistance is high. Therefore, when an electrical current is applied to one of word lines 61, different voltages are detected at the bit lines 63 according to the magnetized state of the bit cells 55. As a result, the stored data is retrieved. Electric current is applied to a selected word line 61 and a selected bit line 63 to write data and the second ferromagnetic layer 73 is magnetized in the reversed direction to the first ferromagnetic layer 71. The MRAM consists of magnetic materials for memory cells and semiconductor materials for driving the magnetic cells. In the MRAM, increasing the density of the magnetic cells is one of the important problems. The magnetic cells of the MRAM are isolated from one another. However, there are the same problems of the exchange interaction and the magneto-static interaction, when the magnetic cells are closely arrayed to increase the area density.

Please replace the first paragraph beginning on page 4 with the following amended paragraph:

The inventors filed a patent with KIPO (Korea Intellectual Property Organization) in July 24, 1998 and the application number 10-1998-029830 was assigned. In this application, method of forming a meta-stable magnetic material and a magnetic material thereby is mentioned. It is shown that a thin magnetic film having advanced magnetic properties is obtained by depositing multi layers of rare earth rare materials and transition elements and by mixing the rare earth rare materials and transition elements using an ion beam including inert gas in a magnetic field. As a result, the magnetic momentum and coerciveness were improved up to 50% after the ion beam mixing. Studies about the magnetism of the magnetic thin film which is treated with the ion beam are done continuously and it is found out that an easy-axis is formed in a thin magnetic film after the ion beam mixing. This patent further exploits the magnetic film having an easy axis and multiple easy axis.

Please replace the last paragraph beginning on page 5 with the following amended paragraph:

The Figs.3a to 3c show a method of forming a meta-stable magnetic material having dual easy axis by an ion beam mixing. In this preferred embodiment, the magnetic material has at least one of rare earth rare materials such as Pt, Pd, Au and Tb and at least one of transition metals such as Co, Fe, and Ni. The ion beam for mixing the earth rare materials and the transition metals includes a selected one

among inert gases such as He, Ne, Ar, Xe and Kr.

Please replace the paragraph beginning on page 6, line 3, with the following amended paragraph:

Referring to Fig 3a, eight Pt layers 111a and eight Co layers 111b are deposited alternatively on a substrate 101 made of glass to form a CoPt multi layer 111 in a vacuum chamber (not shown in figure) with  $8 \times 10^{-7}$  torr. The thickness of each Pt layer 111a is 35Å and that of each Co layer 111b is 45Å so the thickness of the CoPt multi layer 111 is 640Å. Here, an easy axis in the Co/Pt multi layer 111 of which direction is formed along to 170°-350° in the polar coordinate system is detected. As shown in Fig 4, the white circles represent the direction of the easy axis of the CoPt multi layer 111. ~~A first area 211a and a second area 211b are defined in the CoPt multi layer 111.~~

Please replace the paragraph beginning on page 6, line 10, with the following amended paragraph:

Referring to Fig 3b, a first area 211a and a second area 211b are defined in the CoPt multi layer 111. ~~a second~~ Second area 211b is covered with a first mask 113a such as a stencil mask or a photo resist mask. Using an ion beam generator (not shown), an  $\text{Ar}^+$  ion beam 115 is injected into the first area 211a of the CoPt multi layer 111 where the energy of the ion beam 115 is about 80keV. Then the

Co/Pt multi layer 111 is mixed to form a first meta-stable metal layer 121a having CoPt alloy. The first area 211a has a first easy axis having the direction of 200°-20° in the polar coordinate system. The asterisks, in the Fig 4, represent the direction of the first easy axis of the CoPt alloy in the first area 211a.

Please replace the paragraph beginning on page 7, line 8, with the following amended paragraph:

Referring to Fig. 5b, a first area 211a and a second area 211b are defined at the magnetic layer 131. The second area 211[[a]] b is covered with a first mask 113a such as a stencil mask or a photo resist mask. An Ar<sup>+</sup> ion beam 115 is injected into the first area 211a of the magnetic layer 131 using an ion beam generator (not shown) where the energy of the ion beam 115 is about 80keV. Then a first magnetic layer 131a is formed in the first area 211a with a first easy axis having the direction from about 90° to 270° in the polar coordinate system. As shown in Fig 6, the asterisks represent the direction of the first easy axis of the FePt magnetic layer 131a in the first area 211a.

**AMENDMENTS TO THE CLAIMS**

Claim 1 is cancelled.

2. (Currently Amended) A magnetic film comprising:

a substrate;

a magnetic layer forming a plane on said substrate and having a first area and a second area;

[[a]] said first area having a first easy axis with a first direction in said plane; and

[[a]] said second area having a second easy axis with a second direction different from said first direction in said plane.

3. (Original) The magnetic film of claim 2 wherein the angle difference between the direction of the first easy axis and the direction of the second easy axis is from 60° to 90°.

4. (Currently Amended) The magnetic film of claim 2 wherein the magnetic film includes [an] a rare earth rare material which is at least selected one selected from the group consisting of Pt, Pd, Au and Tb.

5. (Currently Amended) The magnetic film of claim 2 wherein the magnetic film includes a transition metal which is at least selected one selected from the group consisting of Co, Ni and Fe.

Claims 6-20 (Cancelled)

**AMENDMENTS TO THE DRAWINGS**

Attached hereto is(are) two(2) sheets of corrected formal drawings that comply with the provisions of 37 C.F.R. § 1.84. The corrected formal drawings incorporate the following drawing changes:

In Figure 2, add reference numeral 55 and its lead line; and

In Figure 6, correct the spelling of the word "easy."

It is respectfully requested that the corrected formal drawings be approved and made a part of the record of the above-identified application.

**REMARKS**

Applicants thank the Examiner for the thorough consideration given the present application. Claims 2-5 remain under consideration. The Examiner is respectfully requested to reconsider his rejections in view of the amendments and remarks as set forth below.

***Drawings***

The Examiner objected to the drawings as failing to show reference numeral 55. Applicants have now amended Figure 2 to add this reference numeral and the appropriate lead line.

The Examiner further objected to elements 211a and 211b not being shown in Figure 3a as described on page 6 of the specification. Applicants have amended the specification in this case to point out that these numerals are present in Figure 3b instead.

***Objection to the Specification***

The Examiner pointed out an error on page 7 of the specification, namely, that the second area is 211b. By way of the present amendment, this has also been corrected.

***Objections to the Claims***

Claim 4 was objected to for using the phrase "earth rare." This has been corrected to "rare earth" in claim 4 and also in the specification. Accordingly, this objection is overcome.

***Rejection Under 35 U.S.C. § 112***

Claims 4 and 5 stand rejected under 35 U.S.C. § 112 second paragraph as being indefinite due to improper Markush group terminology. This phrase has been corrected in both claims as suggested by the Examiner. Accordingly, this rejection is overcome.

***Rejection Under 35 U.S.C. § 102***

Claims 1 to 5 stand rejected under 35 U.S.C. § 102 as being anticipated by the article to Chappert et al. ("Planar Patterned Magnetic Media Obtained by Ion Irradiation, Science, Vol. 280, June 29, 1998). This rejection is respectfully traversed.

Regarding the rejection of claim 1, this claim has now been cancelled rendering this part of the rejection moot.

The Examiner rejected claim 2 as being anticipated by Chappert et al. and pointed out that reference teaches the patterning of a continuous magnetic film utilizing ion beam irradiation to form arrays of adjacent lines having different magnetic properties. In particular, the reference shows having perpendicular

versus in-plane magnetization. Applicants submit that claim 2 as presently amended is not anticipated by this article.

The claim now describes a magnetic film having a combination of elements, including a substrate, a magnetic layer having two areas, with one area having an easy axis in a first direction and a second area having a different easy axis in a different direction, with both directions being in the plane and being different from each other. While admittedly the reference teaches a cobalt-type platinum multilayer exposed to an ion beam of helium ions with adjoining regions having different magnetic properties, the particular magnetic properties described are different from those of the present claimed invention. Thus, claim 2 states that the first area has a first easy axis having a first direction in the plane in the magnetic layer. The second area has second easy axis in the second direction which is different from the first direction and is also in the plane of the magnetic layer. While the reference discusses changing magnetic properties in adjoining regions, it does not discuss the particular change of the easy axis. Accordingly, Applicants submit that claim 2 is not anticipated by this article. Further, Applicants submit that it would not be obvious to use this particular magnetic property since there is no indication in the reference that such a property can be used in adjoining areas. Accordingly, Applicants submit that claim 2 defines thereover.

Claims 3-5 depend from claim 2 and as such are also considered to be allowable. In addition, each of these claims recites additional features of the

invention. Claim 3 describes the angle difference between the two axes, which is not described in this reference. Claims 4 and 5 describe the particular materials of the magnetic film. Accordingly, Applicants submit that claims 3 through 5 are similarly allowable.

***Conclusion***

In view of the above remarks, it is believed that the claims clearly distinguish over the patent relied on by the Examiner. In view of this, reconsideration of the rejection and allowance of all the claims are respectfully requested.

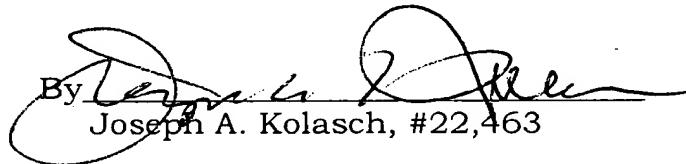
In the event that there are any outstanding matters remaining in this application, the Examiner is invited to contact Robert F. Gnuse at (703) 205-8000 in the Washington, D.C. area.

Pursuant to the provisions of 37 CFR 1.17 and 1.136(a), Applicants respectfully petition for a one (1) month extension of time for filing a response in connection with the present application. The required fee of \$110.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By   
Joseph A. Kolasch, #22,463

P.O. Box 747  
Falls Church, VA 22040-0747  
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JAK/RFG/glh/gf  
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Attachments

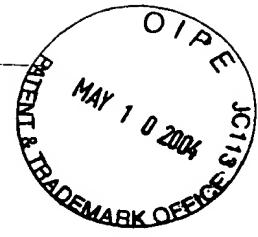


Fig. 1  
Conventional Art

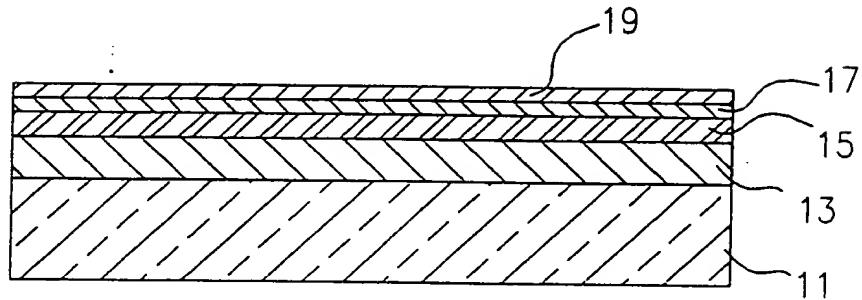


Fig. 2  
Conventional Art

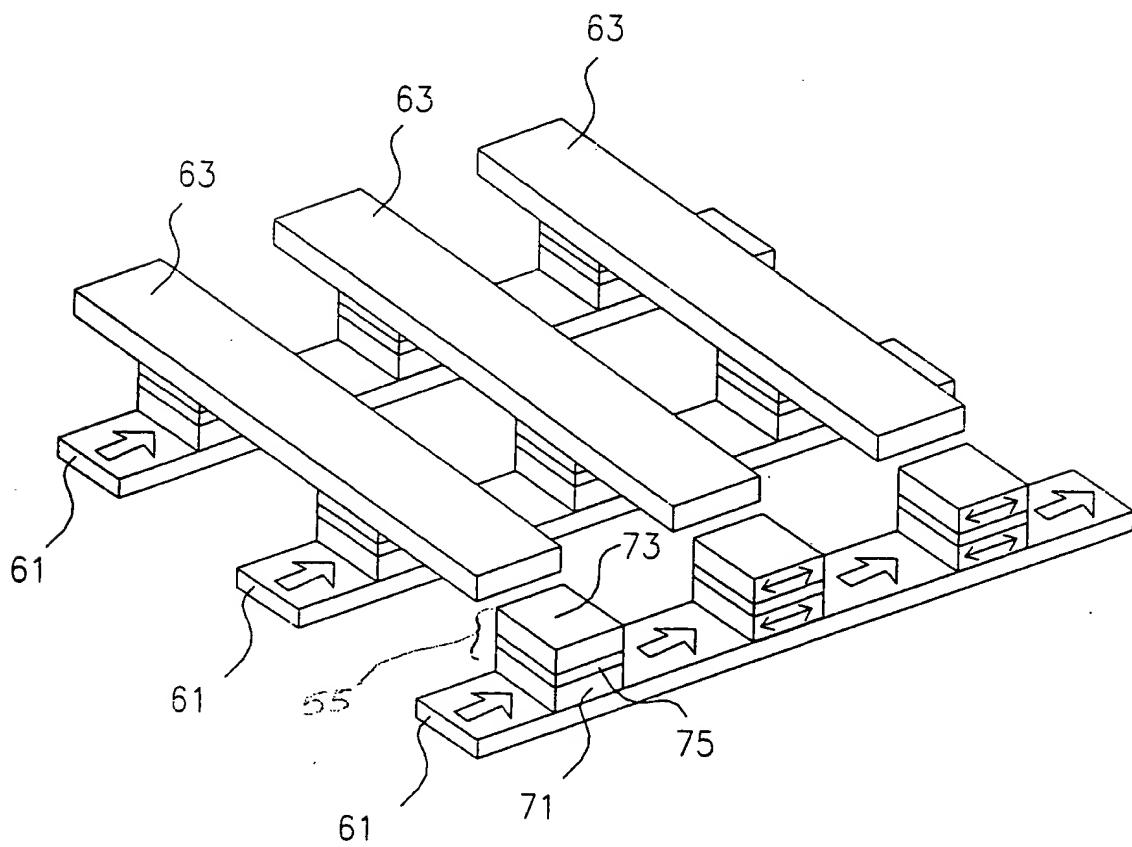
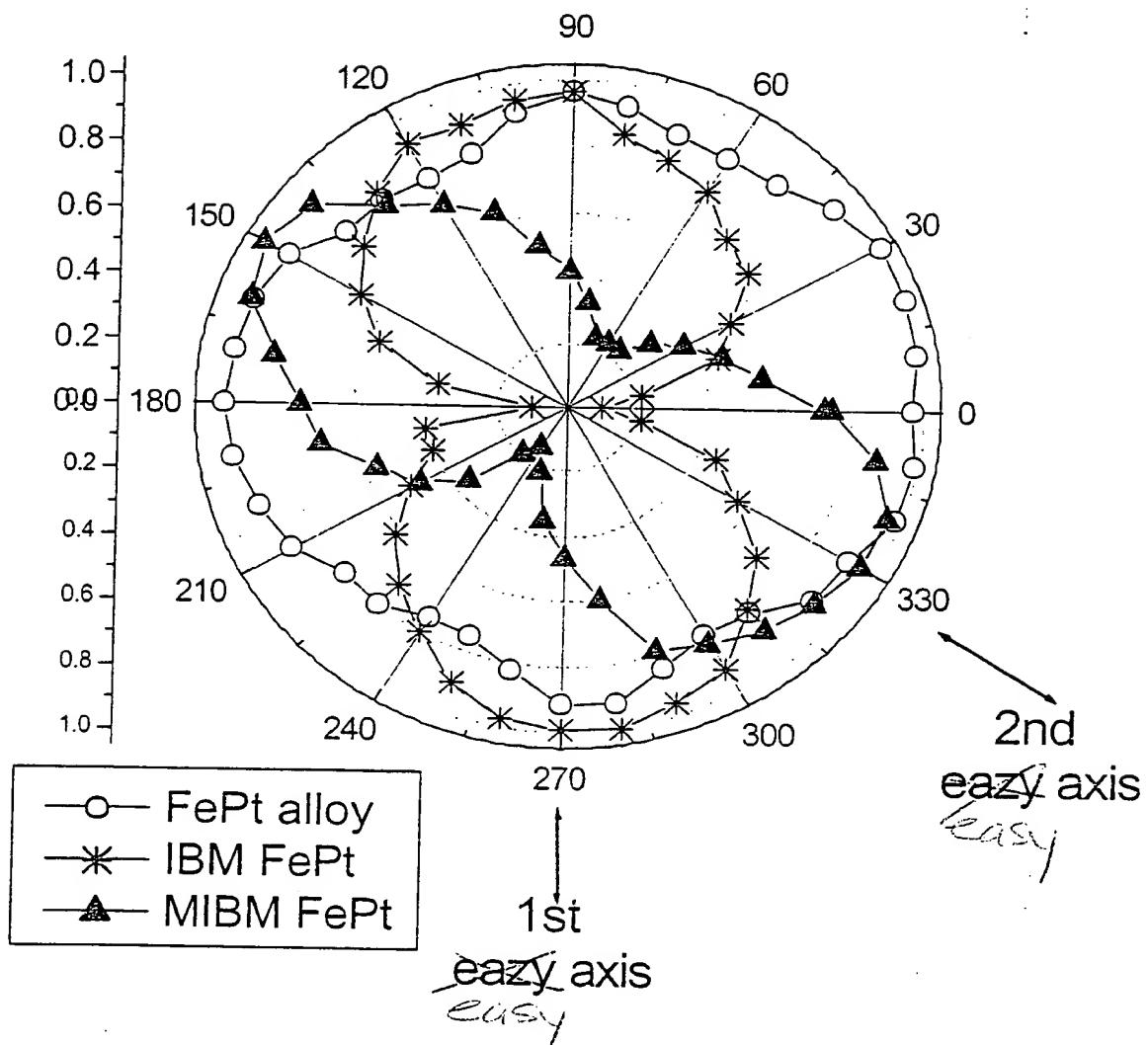




Fig. 6



REPLACEMENT SHEET



Fig. 1  
Conventional Art

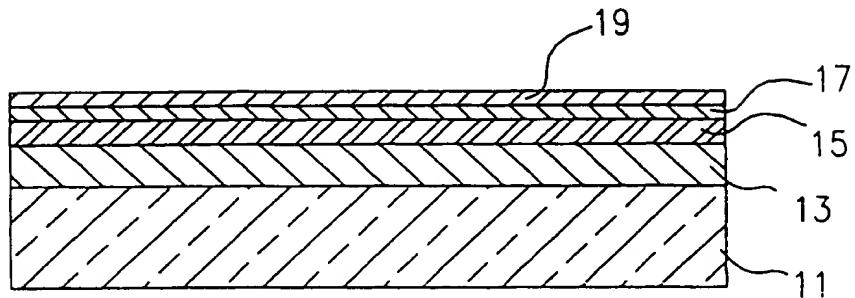
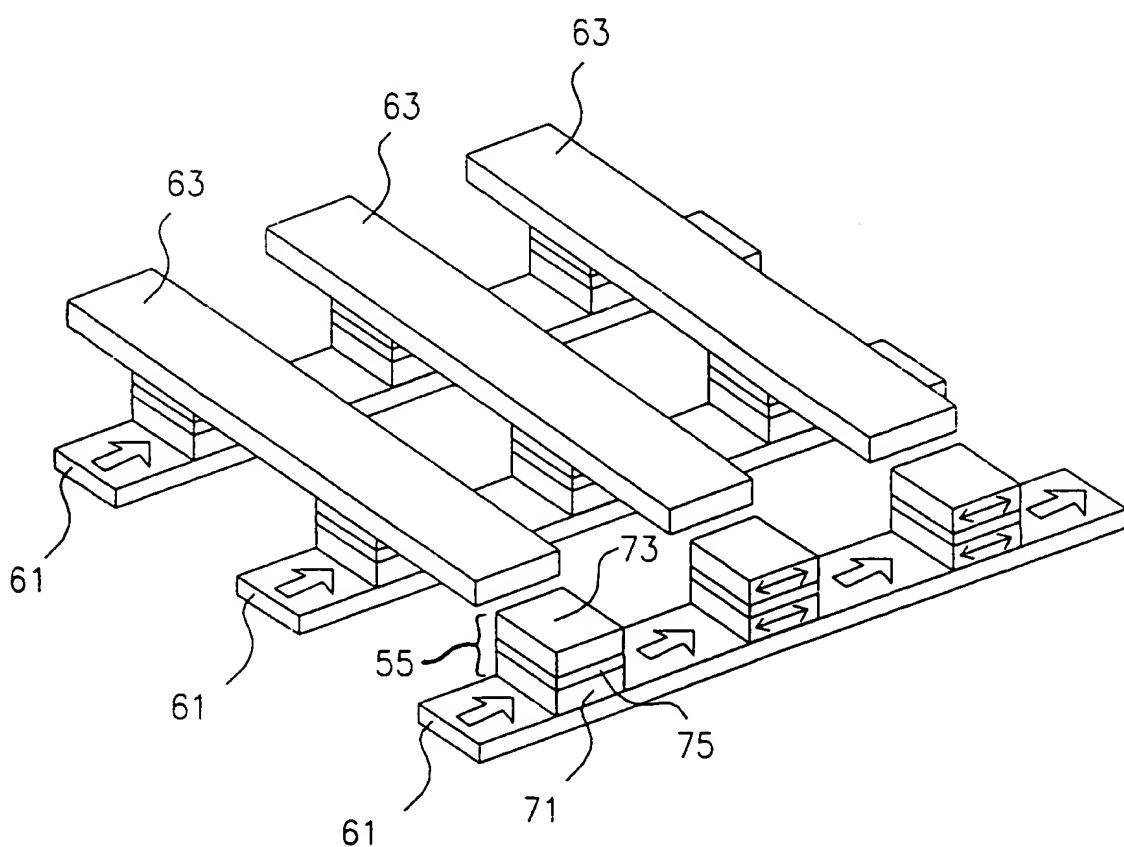


Fig. 2  
Conventional Art



REPLACEMENT SHEET



Fig. 6

